SPACE TO GROW

JSC boosts small businesses for future technologies through Space Alliance

by Amiko Nevills

FINDING SOLUTIONS to reduce weight is second nature to innovators for space. Before America could venture into space to explore the universe, NASA needed to lighten its load. Engineering ingenuity slimmed down computers, cameras, life-support systems and critical hardware to propel spacecraft and their special cargo into space.

So when Mission Technologies Inc. sought for a smart way to reduce the weight of a reconnaissance aircraft launcher, it's no surprise that tinkering minds behind the U.S. space program had the answer.

Mission Technologies, a small business in Texas, had developed an uncrewed aerial vehicle system that could transmit real-time intelligence and surveillance data in wartime to field commanders and ground personnel. There was only one problem – a technical problem.

Before it could become a product in practice by the U.S. Department of Defense, the system's launcher, which serves as a miniature runway for the compact aircraft, needed a sleek redesign.

Answering the call for help, the Space Alliance Technology Outreach Program (SATOP), a consortium of leaders in space and technology, connected Mission Technologies with Johnson Space Center, one of nearly 50 Alliance Partners today.

SATOP began its trek in 1996 to strengthen the economy within rising communities, pairing small businesses with space-age technology and expertise. The nonprofit program, funded and supported by NASA, now spans four states with chapters in Florida, New Mexico, New York and Texas.

In partnership with JSC, the Texas chapter was established within the Bay Area Houston Economic Partnership (BAHEP) in 1998 and expanded to cover the entire state of Texas in 1999. BAHEP, formerly known as the Clear Lake Economic Development Foundation, strives to stimulate economic growth by moving space technology to private industry.

Sharing NASA knowledge is an investment for technological advances from which the Agency may one day benefit for future exploration.

"Anytime we create an innovative company, it becomes a source for future technology needs for NASA," Harry Erwin, JSC Engineer and NASA Executive on Loan to the Economic Partnership, said.

Erwin, who recently celebrated the anniversary of the lunar landing with fellow JSC "Moon people," experienced first-hand the evolution of technology for space and where it can lead here on Earth.

"We invented our way to the Moon," Erwin said. "Technology luxuries we enjoy today like portable computers and cellular phones came to us from technology need."

Through a cooperative network of engineers and scientists from universities, colleges, NASA field centers and aerospace contractors, including Lockheed Martin, Boeing and United Space Alliance, SATOP offers 40 hours of free technical assistance to small businesses. Participating engineers and scientists in the Space Alliance volunteer their time and creative solutions to overcome barriers to innovation.

"The Alliance Partners drive the SATOP engine," SATOP Executive Director Bob Mitchell, said. "Without the extraordinary knowledge and expertise that they freely share with inventors and entrepreneurs, the SATOP program could not exist."

While small businesses like Mission Technologies get a nudge in solving technical challenges to their next breakthroughs, scientists and engineers of the Alliance Partners exercise their leadership on the space front and gain networking opportunities to launch new ideas.

JSC Acting Chief of the Electronic Design Branch Mike Cooke recently began working with Houston-based CavCom, a company that specializes in two-way communication earpieces. The earpieces with built-in speakers and a microphone provide a way to communicate in high-noise environments and, like ear plugs, protect hearing.

"CavCom came to us through the [SATOP] program to remove the cable from the earpieces to the radio," Cooke said. "Their challenge happens to match the same challenge we are currently working on with the Wireless Crew Comm Project."

The Wireless Crew Comm Project, a joint venture between Engineering and Space and Life Sciences, aims to transform the audio terminal unit – the phone aboard the Space Station – to wireless.

Solving the technical challenge for CavCom could create inroads for future communications in space.

"It's a win-win situation, a perfect match," Cooke said. "Their end product may become valuable for future missions."

Fostering innovation through small businesses not only builds a stronger economy but also serves as a technological path for future space exploration to the Moon, Mars and beyond.

"If we can start enough innovative companies, we can harvest a crop of technologies to take us to Mars," Erwin said.

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Through SATOP, NASA helped Mission Technologies, Inc. decrease the size and weight of a reconnaissance aircraft launcher for homeland security. The innovation launched Mission Technologies' growth with a contract to manufacture the compact surveillance systems for the U.S. Department of Defense.

INSET: NASA is helping small business, CavCom, go wireless with its hearing protective two-way communication earpieces. This SATOP project is similar to a current NASA challenge: making the phone aboard the International Space Station wireless.

Team prepares astronauts for on-orbit health experiments

training days

by Kendra Phipps

NASA astronauts are many things: doctors, soldiers, pilots, engineers – even veterinarians. But not all of them are trained scientists.

Before a mission, the crew must be brought up to speed on how to correctly perform experiments on orbit and meet the mission's science objectives. When it comes to experiments on how the human body reacts to space, that training is done by the Human Research Facility (HRF) Training Team.

This 10-member team works with the experiments' designers and principal investigators to train astronaut crews.

"We come from education backgrounds," Joyce Schultz, HRF Training Coordinator, said. "We offer guidance to subject matter experts to make their training more efficient."

The HRF is a rack onboard the International Space Station with instruments designed to support experiments related to how humans adapt to space. One HRF experiment, called Advanced Diagnostic Ultrasound in Microgravity (ADUM), allows Space Station crews to use ultrasound to check for health problems – without the years of training it takes to become an ultrasound technician on Earth.

NASA ISS008E20901

Astronaut Michael Foale, Expedition 8 commander and NASA ISS science officer, balances on the footplate of a special track attached to the Human Research Facility rack in the Destiny laboratory on the International Space Station as part of the Foot Reaction Forces During Spaceflight experiment.

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Pedro Duque, European Space Agency Soyuz crewmember, participates in the Human Research Facility ultrasound proficiency training in Building 9 prior to launching with the Expedition 8 crew in October 2003. Instructor Jessica Meir assists Duque.

The ADUM instructors make this possible with a special technique: prior to their mission, astronauts are given enough training on the ultrasound machine to use it on themselves or a crewmate. However, as part of the experiment, real-time guidance and image interpretation are done by experts on the ground.

"Some guidance and a little training allows crewmembers to do high-enough quality ultrasound images that somebody on the ground could make the medical diagnosis," Schultz said.

To train the crews quickly on ultrasound, the HRF Training Team arranges for an astronaut to practice with the equipment in the HRF training module in Building 9 while an unseen ultrasound expert communicates with him or her through a headset.

"We reduce training time by using cue cards on the ultrasound machine," said Shannon Melton, ADUM instructor and co-investigator. "The cards guide astronauts to find the correct keyboard buttons and specific points on the body."

ADUM has been performed on orbit: NASA ISS Science Officer Peggy Whitson served as an ultrasound "guinea pig" during her 2002 stay aboard the Space Station.

"I was impressed that even with the slight delay in transferring the video images to the ground, I was able to perform – with guidance from the ground team – imaging of my heart, carotid artery, kidney and bladder," Whitson said. "The remote application of these methods has very positive implications for long-duration spaceflight, as well as potential uses here on Earth."

The training methods vary for other HRF experiments. One of them, the Foot Reaction Forces During Spaceflight experiment, investigates how astronauts use specific muscles in space. To track this information, they wear multiple electrodes and angle sensors that monitor the electrical activity of muscles and joints.

"That's one of our more complicated experiments because it involves a lot of equipment and because we train crewmembers to apply electrodes and calibrate the angle sensors," Schultz said. The team has now trained four Expedition crews on the FOOT experiment.

Another experiment, called Pulmonary Function in Flight (PuFF), is designed to help scientists learn more about decompression sickness. Astronauts are at risk of getting this illness, also called "the bends," when transitioning from the Space Station to the different pressure of a spacesuit.

"For the PuFF experiment, training involves having the astronauts become familiar with the hardware and how to set it up, and making them familiar with the in-flight breathing protocol tests," Schultz said.

Results from these HRF experiments are contributing to the Vision for Space Exploration by allowing scientists to study effects of spaceflight on the human body. Not only that, but they also have positive implications for life on Earth: for example, groundbreaking ultrasound techniques are being pioneered with ADUM. These tests in space could improve the health of people on Earth, but they would never get off the ground if not for the preflight work of the HRF Training Team.